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USE OF REFLECTOR BUTTONS FOR DANGER, WARNING, DIRECTION, AND SAFETY SIGNS IN MINES

BY

F. E. GRIFFITH AND H. J. VAN DER VEER

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USE OF REFLECTOR BUTTONS FOR DANGER, WARNING, DIRECTION, AND SAFETY SIGNS IN MINES[1]

By F. E. Griffith[2] and H. J. Van der Veer[3]

INTRODUCTION

Reflector button signs similar to those used to attract the attention of motorists on the public highways at night are now being used to good advantage by a few mining companies in underground workings for danger, warning, direction, and safety signs and signals. Most safety signs and signals used in underground mining are of the electric light, painted-board, or enameled or porcelain metal-plate type, all of which have good features as well as some disadvantages; among the disadvantages are: The filament of electric incandescent lamps is prone to "burn out" occasionally and usually the lamps are not replaced promptly; painted-board and enameled or porcelain metal-plate signs can be seen only a short distance and often are "passed up" unintentionally by employees, consequently these signs do not always serve the purposes intended and may be the cause of injury or death through failure to warn the men of danger.

The advantage of using reflector button signs in mines or underground workings is that the cap lamps or headlights with which employees and locomotives generally are equipped, if directed at these buttons will reflect the light back to its source, and if they are arranged to spell words of warning or direction, or if suitable symbols are used, they are discernible and can be read at a distance of several hundred feet. The distance the light is reflected depends largely on the color of the buttons used. The reflector buttons also in many instances can be used to good advantage in conjunction with other methods previously mentioned.

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[1] The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from Bureau of Mines Information Circular 6980."

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TYPES AND DESIGN OF REFLECTOR BUTTONS

Several types of reflector buttons are available, among them the flat-lens type with mirrored metallic foil or plate back, the facet-cut-lens type with a mirrored metallic foil or plate back, and a type with a hemispherical smooth lens with a parabolic mirrored metal back. Lenses for the different types are available in several colors. Crystal, amber, red, and green are the colors of the buttons used to the greatest extent in underground signs up to the present time. These buttons may be had in different sizes, also.

It has been observed that crystal-colored buttons reflect light the greatest distance (about 1,000 feet) and red-colored buttons the least (about 500 feet); reflection from green and amber colors ranges somewhere between the red and crystal colors in distance.

Reflector Units or Buttons Best Suited For Underground Use

Reflector buttons for underground use should be designed to reflect light a maximum distance; they should be made of materials that resist oxidation and corrosion, especially of the mirrored backs, and should be relatively free of protruding parts or projections that will collect dust.

Reflector buttons approximately 3/4 inch in diameter seem best suited for underground use in general because fewer reflector units are required for a signal of given size.

Standardized Signals Used by One Company

One coal company that operates several mines in Pennsylvania and West Virginia has standardized its signals and signs made from reflector buttons. The system and design of signals are as follows:

For single letter, number, or symbol signals, a circular wood block approximately 6-1/2 inches in diameter and 1-1/2 inches thick is used. Holes are drilled into this wood block to accomodate the reflector units, the holes following generally the contour or outline of the figure to be used. These blocks are painted a dull flat black or creosoted.

Track crews, timber crews, electricians, machine crews, etc., are provided with two signal blocks for each crew. A crew symbol, number, or letter is placed on each side of the block, different colored reflector buttons being used.

In the color scheme, red denotes danger; amber, proceed with caution; green, clear ahead; and the crystal units are utilized for direction signs, arrows, etc.

Crew Symbols, Letters, and Numbers Used

For electricians and wiremen: Capital Z placed at an angle of 45° represents an electric flash. Red-colored reflector units making up the symbol are used on each side of the signal block.

For machine and post pulling crews: A number (6, 7, 8, etc.) is used to designate the crew. On one side of the signal block the number is in red and on the other side in amber units.

For trackmen, timbermen, road cleaners, and others: The symbol used is in the form of a star - on one side of block amber units are used and on the other side red, the red reminding of possible danger and the amber that caution should be used in going ahead.

Other Symbols in Signal System

For switch throws: A circle on one side in green and on the other in crystal colored units.

For runaway switches: A circle in red units on each side of the block.

For fire extinguishers: Letter X in crystal units on each side of the block.

For first-aid station: A cross (+) in crystal units on each side of the block.

Caution: Amber units are used.

Danger: Red units are used.

All other signs, such as "Look out for cars", "2N" (second north), "M. E." (main east), "MANWAY ⟶ ", "EXIT ⟶ ", etc.

Each crew is equipped with signal blocks to be placed a hundred or more feet inby and outby the working place.

This particular company is not using signal blocks studded with reflector units or buttons as danger signals on the rear of moving underground trains or trips. The mining laws of some States specify that a light shall be carried on the front and rear of all moving trains, and since reflector buttons are not a source of light, but merely reflect the light from some other light source, they would not comply with this provision of the mining law. The principal objection to their use on trips is that if an employee should lose his light while traveling or working on the haulage system he would not be warned of the moving train by this type of sign.

RECOMMENDATIONS

Reflector units should be placed in the block so as to protrude slightly from the surface, they should be held in place with shellac or other fastener, and the completed signal should be provided with a hook or ring to attach or suspend it at the desired location in the mine.

In some instances it may be desirable to place signals so they will be visible from either direction of travel, in which case the signal should be made so that reflector buttons can be placed on both sides of the block of wood. Any signal in a mine is useless if it is poorly or improperly suspended at its station; brackets should be bolted to the signal and then to a plug or timber at the desired location.

The signal should be suspended in such a way that air currents will not cause it to sway or turn about, and should be rigid enough so that an ordinary blow will not knock it from its place.

The signal block for warning purposes should be in a conspicuous spot in the cross section of the entry or room, preferably in the center of the haulage and elevated about 2 to 3 feet from the floor, depending on height of the entry. A sharpened 1/2-inch steel rod about 3 feet long, with "S" hook at the top, and driven into the floor or wood tie, can be used to suspend the signal block.

CONCLUSIONS

The favorable reaction and comments of mining officials and others, who have had an opportunity to see signs and signals made of reflector buttons, indicate that they are favorably impressed with this relatively recent innovation.

The mining officials contend that in addition to the safety feature, machinemen, track and timber crews, and other repairmen are easily located while making their rounds if an emergency arises and these employees are needed elsewhere.

Locomotive operators have been relieved of considerable anxiety by these signs along haulageways where repairs are being made and at dangerous intersections and danger spots. The signs have been a definite aid, also, to those trying to find a first-aid station or fire extinguishers or to find their way into and out of the various parts of the mine.

Certainly, the reflector-button signs are well worth while for the latter purpose, and mines that have auxiliary or emergency exits that are traveled or used infrequently should by all means mark such places carefully with reflector-button direction signs so that those who may have to use such emergency exits will have some definite guidance that they are going the right way. It would appear that our mining companies are losing a good opportunity in failing to use these reflector button not only for safety purposes but also for numerous operating features, and this is the more surprising because of the fact that night travelers on automobile highways have had very definite service from reflector button signs for quite awhile.